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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/587,844	07/28/2006	Jun-ichi Nishizawa	294225US2PCT	3514

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EXAMINER	
CARTER, MICHAEL W	
ART UNIT	**PAPER NUMBER**
2828	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/587,844	NISHIZAWA ET AL.	
	Examiner	Art Unit	
	MICHAEL CARTER	2828	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 July 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *28 July 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *7/28/06*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

1. **Claims 1, 10, and 15** are objected to because of the following informalities: The claims recite "being liked with the change of external intersection angle". This appears to be a typo which should be "linked" instead of "liked." For purposes of the art rejection below, it is assumed to be "linked." Appropriate correction is required.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. **Claims 1-2, 10, 15, and 18** are rejected under 35 U.S.C. 102(b) as being anticipated by Tanabe et al., "Frequency-tunable high-power terahertz wave generation from GaP," Journal of Applied Physics, vol. 93, 4610 (2003) (hereinafter referred to as Tanabe).

4. **For claims 1 and 15,** Tanabe teaches a first pump beam emitter configured to emit a first pump beam having a wavelength larger than one micrometer (figure 1, Nd:YAG laser); a second pump beam emitter configured to emit a wavelength-tunable second pump beam having a wavelength larger than one micrometer, the wavelength of which is different from the wavelength of the

first pump beam (figure 1, OPO excited by YAG); a nonlinear optical crystal configured to generate an electromagnetic wave of a difference frequency between the first and second pump beams (figure 1, GaP); and an optical system configured to irradiate the first and second pump beams to the nonlinear optical crystal, by adjusting an external intersection angle between the first and second pump beams within 0.5° at the difference frequency of 1 THz (figure 3), wherein a frequency-tunable terahertz electromagnetic wave is generated in the nonlinear optical crystal, by changing the frequency of the second pump beam, being linked with the change of the external intersection angle (section II, paragraph 3) the adjustment of the external intersection provides implies an angle control mechanism.

5. **For claims 2 and 18,** Tanabe teaches the nonlinear optical crystal is GaP crystal, $ZnGeP_2$ crystal, or GaSe crystal (abstract)..

6. **Claim 10** is rejected according to the arguments made for claim 1 above. Further, Tanabe further teaches a timing control mechanism configured to control arrival timings of pulses of the first and second pump beams to the nonlinear optical crystal (section II, paragraph 3).

7. **Claims 7, and 9** are rejected under 35 U.S.C. 102(b) as being anticipated by Wei Shi et al., "Efficient tunable, and coherent 0.18-5.27 – THz source based on GaSe crystal," Optics Letters, vol. 27, 1454 (2002) (hereinafter referred to as Wei Shi).

8. **For claims 7 and 9**, Wei Shi teaches a first pump beam emitter configured to emit a first pump beam (figure 1, ND:YAG); a second pump beam

emitter configured to emit a wavelength-tunable second pump beam (figure 1, MOPO), the wavelength of which is different from the wavelength of the first pump beam; and a nonlinear optical crystal configured to generate an electromagnetic wave of a difference frequency between the first and second pump beams (figure 1, GaSe), wherein a frequency-tunable terahertz electromagnetic wave is generated in the nonlinear optical crystal, by changing the frequency of the second pump beam wherein the nonlinear optical crystal is $ZnGeP_2$ crystal or GaSe crystal (figure 1, GaSe).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. **Claims 3 and 19** is rejected under 35 U.S.C. 103(a) as being unpatentable over Tanabe in view of Sobey et al., US Patent 5,457,707 (hereinafter referred to as Sobey).

11. **For claims 3 and 19,** Tanabe is applied as to claims 1 and 15 above.

Tanabe does not teach an injection seeding mechanism.

However, Sobey does teach an OPO with injection seeding mechanism in order to narrow create line narrowing (figure 1 and column 2, lines 19-20).

It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to combine the injection seeding with Tanabe's device in order to narrow create line narrowing.

12. **Claims 4-6, and 20** are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanabe in view of Furusawa et al., "Cladding pumped Ytterbium-doped fiber laser with holey inner and outer cladding," Optics Express, vol. 9, 714 (2001) (hereinafter referred to as Furusawa).

13. **For claims 4-5, and 20** Tanabe remains applied as to claims 1 and 15 above.

Tanabe does not teach the first pump beam emitter comprises a first pump source implemented by any one of Cr-doped forsterite laser, ytterbium-doped yttrium-lithium-fluoride laser, and ytterbium-doped fiber laser, configured to emit the first pump beam; and the second pump beam emitter comprises a second pump source implemented by any one of Cr-doped forsterite laser, ytterbium-doped yttrium-lithium-fluoride laser, and ytterbium-doped fiber laser, configured to emit the second pump beam further comprising an excitation light source configured to excite the first and second pump sources so as to emit the first and second pump beams from the first and second pump sources, respectively.

However, Furusawa teaches an ytterbium-doped fiber laser which is tunable (figure 5) and pumped by an excitation light source (page 719, lines 1-2).

The particular pumps used in Tanabe do not appear critical to the operation of the device, therefore it would have been obvious to one skilled in the

art to substitute the known laser of Furusawa into the system of Tanabe by an obvious engineering design choice.

14. **For claim 6,** Tanabe further teaches a timing control mechanism configured to control arrival timings of pulses of the first and second pump beams to the nonlinear optical crystal (section II, paragraph 3).

15. **Claims 8** is rejected under 35 U.S.C. 103(a) as being unpatentable over Wei Shi in view of Furusawa.

16. **For claim 8**, Wei Shi remains applied as to claim 7 above.

Furusawa is applied as to claim 4 above.

17. **Claims 11-13** are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanabe in view of JP Publication 2002-287190 (hereinafter referred to as '190).

18. **For claim 11**, Tanabe remains applied as to claim 10 above.

Tanabe does not teach the first pump beam emitter comprises a first pump source implemented by any one of Cr-doped forsterite laser, ytterbium-doped yttrium-lithium-fluoride laser, and ytterbium-doped fiber laser, configured to emit the first pump beam; and a second pump beam emitter comprises a second pump source implemented by any one of Cr-doped forsterite laser, ytterbium-doped yttrium-lithium-fluoride laser, and ytterbium-doped fiber laser, configured to emit the second pump beam.

However, '190 teaches a Cr-doped forsterite laser which is tunable (drawing 5) and can be used in difference frequency generation (claim 1).

The particular pumps used in Tanabe do not appear critical to the operation of the device, therefore it would have been obvious to one skilled in the art to substitute the known laser of '190 into the system of Tanabe by an obvious engineering design choice.

19. **For claim 12,** Tanabe further teaches the timing control mechanism controls the timing by adjusting time lag between excitation light pulses configured to excite the first and second light sources, respectively (section II, paragraphs 2-3).

20. **For claim 13,** '190 further teaches YAG rods for generating pulses within the first and second pump source (drawing 1, label 16).

21. **Claims 14** is rejected under 35 U.S.C. 103(a) as being unpatentable over Tanabe in view of JP Publication 05-110179 (hereinafter referred to as '179).

22. **For claim 14,** Tanabe does not teach a beam splitter configured to divide a beam of terahertz electromagnetic wave being emitted from the nonlinear optical crystal; and a feedback detector configured to feed back detected output to the timing control mechanism, by detecting an intensity of the divided beam, wherein the timing control mechanism controls the timing so as to maximize the detected output.

However, '179 does teach a beam splitter configured to divide a beam of an electromagnetic wave being emitted from the nonlinear optical crystal; and a feedback detector configured to feed back detected output to the timing control mechanism, by detecting an intensity of the divided beam, wherein the timing

control mechanism controls the timing in order to control the output power(drawing 8 and paragraph 18).

It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to combine the detection in '179 with Tanabe's device in order to control the output power.

23. **Claims 16** is rejected under 35 U.S.C. 103(a) as being unpatentable over Tanabe in view of Hebert et al., U SPG Pub 2005/0134847 (hereinafter referred to as Hebert).

24. **For claim 16,** Tanabe teaches first off-axial paraboloid reflector configured to reflect the electromagnetic wave emitted from the electromagnetic wave exit face; a second off-axial paraboloid reflector (section 2, paragraph 3).

Tanabe does not teach the mirror is configured to move on a linear stage against the first off-axial paraboloid reflector, reflecting the electromagnetic wave reflected by the first off-axial paraboloid reflector; and a position controller configured to control position of the second off-axial paraboloid reflector so that the electromagnetic wave emitted with a specific exit angle against the electromagnetic wave exit face can focus into an arbitrary point, irrespective of the exit angle.

However, Hebert does teach adjusting the position of a parabolic mirror in order to change the focus of a beam of light, and linear stages are well known in the art to change positions of optical elements.

It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to combine a linear stage with one of the mirrors in

order to change the position and focus, according to Hebert, of the electromagnetic wave in Tanabe..

25. **Claim 17** is rejected under 35 U.S.C. 103(a) as being unpatentable over Tanabe in view of Nillsson US Patent 5,566,197 (hereinafter referred to as Nillsson) and further in view of Kawase et al. US PG Pub 2004/0061055 (hereinafter referred to as Kawase).

26. **For claim 17,** Tanabe remains applied as to claim 15. Tanabe does not teach a rotatable first incident mirror configured to reflect the first pump beam so as to adjust an incident angle with which the first pump beam irradiates to the nonlinear optical crystal; a rotatable second incident mirror configured to reflect the second pump beam so as to adjust another incident angle with which the second pump beam irradiates to the nonlinear optical crystal; a terahertz-generator rotation stage on which the first and second incident mirrors are mounted, configured to turn around on an exit point, defining the exit point as a central axis of the rotation, wherein the electromagnetic wave emitted with a specific exit angle against the electromagnetic wave exit face is controlled to focus into an arbitrary point, irrespective of the exit angle, by rotating the terahertz-generator rotation stage.

However, Nillsson does teach two rotatable mirrors can be used to adjust the angle of incidence (figure 1 and column 3, lines 20-25), and therefore the intersection angle between two beams.

It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to combine the mirrors in Nillsson with Tanabe device in order to adjust the intersection angle between two beams..

Kawase teaches placing the terahertz wave generator on a rotation stage (figure 3, label 13) in order to switch between different wavelengths (paragraph 47).

It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to combine Kawase's rotation stage with the previous combination in order to switch between different wavelengths.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Carter whose telephone number is (571) 270-1872. The examiner can normally be reached on Monday-Friday, 7:00 a.m.-4:30 p.m., EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, MinSun Harvey can be reached on (571) 272-1835. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-

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/MC/